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THE LYMPHATIC CONSTITUTION, AND ITS RELATION TO SOME FORMS OF SUDDEN DEATH

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UNDER the term *constitutio lymphatica* have rather recently been described a series of cases presenting a characteristic hyperplasia of the lymph nodes, spleen, thymus, and often of the lymphoid marrow, associated with hypoplasia of the heart and aorta, and frequently also with rha-chitis. These pathological conditions have been found especially in cases of sudden death, from a variety of causes, and are believed by many to indicate in these subjects diminished vital resistance and special liability to sudden cardiac paralysis.

The importance of the *constitutio lymphatica* and its relation to some forms of sudden death, especially to fatalities under chloroform narcosis, have been recognized for several years by the Vienna school of pathologists, but have received very scant attention elsewhere.

Two cases of sudden or unexpected death which have recently come to the writer's hands have shown in a striking degree some of the characteristic anatomical features of the lymphatic constitution, and seem to furnish rather convincing evidence of the correctness of the views recently advanced in regard to this condition.

In addition to the report of these cases, the writer has endeavored to briefly review the evidence on which are

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based the present views on the subject, and further, to consider in some detail the separate features of the lymphatic constitution and their pathological aspect in this and other conditions.

CASE I.—E. F., a girl, aged five years. Parentage, Irish.

Family History.—No relatives were known to have suffered from tuberculosis, enlargement of lymph nodes, tumors, or from any tendency to hæmorrhages or anæmia. Several immediate relatives died of nephritis, rheumatism, and endocarditis. Father and mother have always been healthy. A brother, two years old, was carefully examined on account of a possible reproduction of some of the conditions seen in the sister. This child looked well. All superficial epiphyses seemed normal, and there were no signs of rhachitis other than a markedly protuberant abdomen. The cervical lymph nodes were distinctly palpable from the angle of the jaw to the clavicle. In one axilla a considerably enlarged node was detected. The inguinal nodes were of moderate size and not distinctly enlarged. The epitrochlear nodes could not be felt. The tonsils were moderately enlarged, but not hyperæmic, being identical in appearance with those found at autopsy in the sister. The child always breathed through the nose. The thyroid was not enlarged; the thymus could not be detected; the area of splenic dullness was not enlarged, although distinct.

Examination of the blood showed the red cells to be normal. There was a moderate increase of leucocytes, of five hundred of which seventy-six per cent. were uninuclear, mostly small or medium-sized lymphocytes, twenty-two per cent. multinuclear, two per cent. eosinophile. No normoblasts were seen.

The examination of this child indicated therefore, indistinctly, a constitutional tendency similar to that demonstrated at autopsy in the sister. That the child is really a subject of the lymphatic constitution it is not intended to state, but that a series of such examinations would be a desirable addition to our knowledge it is hardly necessary to urge.

A baby brother of four months appeared perfectly healthy.

Previous Personal History.—The child had always been regarded as healthy. At two years and a half had had measles, the attack being of moderate severity. Three months before her death she had a mild attack of

scarlatina, while the younger brother was passing through a very severe attack. The appetite was always good, and there were no previous gastro-intestinal, pulmonary, or renal symptoms, except a tendency to constipation.

On October 5th the patient fell by accident in the street and received an incised wound of the tongue, which had been caught between the teeth. The bleeding from the wound continued for an hour and alarmed the mother, who brought the child, pale and frightened, to the Roosevelt Hospital, out-patient department.

The further history of the case was furnished through the kindness of Dr. Zerega. Chloroform was administered in order to place a few sutures in the wound, which was still bleeding moderately. The anæsthesia proceeded uneventfully for fifteen to twenty minutes. The inhalations had been interrupted once to allow the stitching to proceed. The child had partly regained consciousness and the inhalations were again begun, when it was noticed that the face was very pale, and the pulse, previously good, was impalpable. Vigorous attempts at resuscitation, including tracheotomy and artificial respiration, were without effect. The pulse never returned, the breathing failed steadily, and although feeble gasps were elicited at intervals for half an hour, respiration finally ceased entirely, and the child was pronounced dead.

Autopsy (twenty hours after death).—Body well nourished, without rigor. Post-mortem lividity faint, the skin being generally pale. Heart: Size normal, walls flaccid, left ventricle contains an ounce of dark fluid blood. Right chambers moderately filled with dark fluid blood. Endocardium normal. A few subpericardial ecchymoses. Aorta of normal size. Lungs: Blood contents considerable. There are numerous subpleural ecchymoses. Bronchi: Beginning suddenly an inch below the cricoid cartilage—that is, at the level of the tracheotomy wound—the bronchi are deeply reddened. No foreign matter in trachea or bronchi. Mucous membrane of larynx and epiglottis slightly shrunken. Liver contains much fluid dark blood. Thymus measures $7 \times 5 \times 2$ centimetres and covers the upper third of pericardium. Spleen slightly enlarged. Malpighian bodies extremely prominent, looking like large miliary tubercles. Pulp very hyperæmic. Stomach: The solitary follicles, especially about the pyloric end, are distinctly visible. Intestine: Throughout the entire intestinal tract, especially in the ileum, the solitary follicles are very prominent.

Peyer's patches are enormously hypertrophic. The lower lenticular patches measure eleven to nine centimetres in length, and the enlarged nodules of the lowermost patch appear as distinct polypoid outgrowths half a centimetre high. The mesenteric nodes are all very much hypertrophied, forming a solid mass of lymphoid tissue, in which the outlines of the individual nodes are intact, while the separate superficial nodules are distinctly visible through the capsules. The mass of these nodes appears quite large enough to have been palpated through the abdominal wall. The faucial tonsils are moderately enlarged, but not hyperæmic. The lingual tonsils are moderately enlarged. The axillary and cervical lymph nodes are slightly enlarged. The bronchial nodes appear normal in size. The bone marrow was not examined. There are no evidences of rhachitis in the ribs, skull, or superficial epiphyses. The brain appears normal. The pia is congested and slightly cedematous. The chorioid plexuses are intensely congested. The examination of the blood of a small pial vein shows the red cells to be normal in appearance. Of five hundred leucocytes, eighty-four per cent. are uninuclear, and of small or medium size, sixteen per cent. are multinuclear, and no eosins were found.

The autopsy indicated, therefore, death by asphyxia, as shown by the dark color and fluidity of the blood, the general venous congestion of the viscera, and the subpericardial and subpleural ecchymoses.

Microscopical Examination.—Spleen: The densely packed masses of lymphoid cells of the Malpighian bodies were usually sharply marked off from the pulp tissue, but in some instances the surrounding pulp tissue was infiltrated for some distance with a considerable number of lymphoid cells. Some of the Malpighian bodies consisted of two symmetrical portions surrounding separate small adjoining arteries, and often in these cases one portion of the follicle consisted of the very densely packed masses of lymphoid cells, while in the other portion the cells were not more numerous than in the normal spleen. A few small collections of lymphoid cells were scattered throughout the pulp tissue without connection with Malpighian bodies.

The splenic sinuses were uniformly dilated and gorged with blood. There was a markedly increased deposit of pigment granules throughout the organ, approaching in grade that of malaria or pernicious anæmia. This pigment appeared under three different conditions: (1) The sinuses contained many macrophages inclosing many

fine, brownish-black pigment grains, most abundant about the nuclei. (2) Lying free in the sinuses were many large, single or conglomerate, yellowish, translucent granules of about the size of red blood-cells. (3) Conglomerate masses of black granular pigment were occasionally seen lying free in the sinuses. Potassium ferrocyanide and acidified glycerin developed a moderate reaction of diffuse hæmosiderin. There were no evidences of interstitial splenitis.



Photograph of the lowest Peyer's patch in Case I. Enlarged one third above natural size. (From photograph by Dr. E. Leaming.)

In the polypoid masses of the Peyer's patches the follicles were much increased in number, the proliferation zones were very distinct, and a very few outlying small collections of lymphoid cells were found close to the muscularis. There was an entire absence of pigment in the lymphoid follicles of the gastro-intestinal tract. The

mesenteric lymph nodes showed uniformly the appearances of simple hyperplasia without inflammation.

The signs of the lymphatic constitution were, therefore, general hyperplasia of the lymphoid organs, including thymus, spleen, gastro-intestinal and mesenteric lymph nodes, the faucial and lingual tonsils, and the cervical and axillary lymph nodes. Hyperplasia of the heart and aorta was not present, and there were no evidences of rhachitis.

CASE II.—M. B., female, aged twenty-seven years; was brought to Sloane Maternity Hospital, January 31, 1896, suffering from shock and hæmorrhage, due to attempts to deliver a full-term child through a contracted pelvis. A high forceps operation had been attempted unsuccessfully. Version had then been performed, and the child's body had been twisted from the head and extracted, leaving the head *in utero*. On admission the patient's pulse was 132, and she was extremely pallid, evidently having lost considerable blood.

The head was removed by cephalotripsy, and the adherent placenta was detached with the further loss of eleven ounces of blood. Active stimulants were administered, with the result of improving the patient's condition considerably and reducing the pulse to 92, but she failed gradually, with symptoms of shock and hæmorrhage, and died six hours after admission—fifteen hours after the beginning of labor.

Autopsy (eight hours after death).—Body of a moderately fat, rather large woman; skin pale; no œdema; slight rigor mortis. Heart is distinctly under normal size. Wall of left ventricle slightly hypertrophied. Valves normal. Aorta abnormally small, down to division of iliac branches. Lungs slightly congested. Liver: Consistence reduced, centres of lobules slightly reddened, peripheries very light colored. Kidneys: Size normal, capsule not adherent, markings slightly irregular, but distinct. Spleen soft, anæmic. Malpighian bodies indistinct. Gastro-intestinal tract normal. Uterus shows a linear tear of cervix, extending for three inches up through internal os and out into right broad ligament. Perinæum torn to sphincter ani. Pelvis: Sacrum is sunken downward and forward, diminishing antero-posterior diameter of pelvis, which measures nine centimetres, and widening the transverse diameter. Acetabula point forward: Superior strait is obstructed by forward projection of lumbar vertebræ, a deformity which is balanced by deficiency of vertebral bodies posteriorly and marked lordo-

sis. The antero-posterior diameter of the chest is increased. The thymus is persistent, measuring $5 \times 3 \times 2$ centimetres. The lymph nodes are not enlarged. The blood content of the viscera and vessels is moderately diminished. The thyroid gland is considerably enlarged and its consistence somewhat firmer than is usual.

In this case the indications of the *constitutio lymphatica* consisted in the marked evidences of old rha-chitis, the hypoplasia of the heart and aorta, and the persistence of the thymus.

It does not appear from the history that the patient showed any marked lack of vitality, and the case is reported rather to show the doubtful importance of some of the conditions now believed to indicate the presence of the lymphatic constitution. It was, however, the opinion of the attending physicians that the patient's death was inadequately explained by the shock of the operations and the loss of blood, and the fatal termination was a matter of surprise, especially after the temporary improvement following the completion of the labor.

CONSIDERATION OF THE SEPARATE FEATURES OF THE CONSTITUTIO LYMPHATICA.—The observations which have resulted in the present views of the lymphatic constitution have been accumulating for a long series of years, and have had reference to a great variety of abnormal conditions or distinct diseases. The very wide scope of these observations, moreover, while largely responsible for the present uncertainty as to the real limits of this term "lymphatic constitution," is yet strong *a priori* evidence that it represents an important fact in pathology.

These observations have been drawn from the study of chlorosis, leucæmia, pseudo-leucæmia, and hæmophilia in the province of the blood, of congenital hyperplasia and hypoplasia of various organs and tissues, of enlargement of the thyroid gland, with or without Basedow's disease, of enlargement of the thymus, of rhachitis, of the fatal effects of chloroform narcosis, and of the large class of cases of sudden death without organic lesions coming under the notice of medical jurists.

In all of the above conditions it has long been apparent that there was frequently associated a systemic weakness which, among other things, rendered the subject liable to sudden heart failure and death under a variety of apparently inadequate exciting causes.

The anatomical features which are at present believed to characterize the subjects of the lymphatic constitution include hypoplasia of the heart and aortic system of vessels, partial or general hyperplasia of the lymphatic organs, the spleen, thymus, lymph nodes, and the lymphoid or red marrow. There may also be evidences of rhachitis. The hyperplasia of the lymphatic structure of varying extent is the most constant and the essential characteristic, hypoplasia of the heart and aorta is frequently added, and evidences of rhachitis are present in the majority of instances. Enlargement of the thyreoid appears so frequently in the reports of recent cases as to call attention to the possible importance in the morbid condition of changes in this organ.

Hypoplasia of the Heart and Aorta.—One of these conditions earliest studied is the hypoplasia of the heart and blood-vessels, first claimed by Virchow to be the fundamental pathological condition in chlorosis, and known to be frequently associated with certain other abnormities in the blood and blood-vessels. The diminished vital resistance of such subjects and their liability to secondary organic diseases were regularly noted by medical writers between 1860 and 1880, and special contributions, with illustrative cases, were made by various authors, such as Wunderlich, Riegel, Kulenkampff, and Kussner. More recently, Handford, Leyden, and Fraentzel have pointed out the frequent connection of arterial hypoplasia with cardiac disease.

Rokitansky, Virchow, Riegel, and Bruberger have reported cases of rupture of these imperfectly developed vessels.

Virchow's theory of the origin of chlorosis was supported and further extended to hæmophilia by the observations by Copeland and Bamberger of the coincidence of both of these diseases of the blood with congenital

narrowing of the aorta. Otto and Rokitsansky noted the frequency with which this anomaly was associated with hypoplasia of other tissues and organs. A case of this description has recently been reported by Israel. Recklinghausen found a general infantile grade of development in a woman of twenty-five years dying of acute phthisis, and showing in addition to hypoplasia of heart and aorta, a patent foramen ovale, a persistent thymus, lobulated kidneys, and infantile pelvis and sexual organs.

The diminished resistance of these subjects to infectious diseases has been observed in cholera by Virchow, in pneumonia by Ortnier, in typhoid fever by Fraentzel, Virchow, and Benecke. In two cases of sudden death during convalescence from typhoid fever, Hiller found uniform narrowing of the aorta. Ortnier endeavors to explain the fatal course of some reported cases of anæmia after complete removal of the cause, the *Bothriocephalus latus*, by the coexistence of a narrow aorta and undeveloped sexual organs, which were found at autopsy in these cases.

Such miscellaneous observations might be multiplied at length, but sufficient evidence has been reviewed to show that hypoplasia of the heart and arteries, which is a prominent anatomical feature of the *constitutio lymphatica*, is often of itself an evidence of a congenital defect in physical development, and indicates a diminished vital resistance in the organism.

Whether cases presenting this anomaly alone should be classed with those showing more fully the features of the lymphatic constitution, the writer does not believe that the evidence at present available is sufficient to decide. For the present purpose it need only be claimed that the existence of this abnormality is in itself a probable ground for the belief that the subjects of the *constitutio lymphatica* possess inferior vital resistance.

Hyperplasia of the Lymphatic Organs.—The hyperplasia of the lymphatic structures of the body is a more recent contribution to the pathology of this form of diminished vital resistance, and the demonstration of its essential importance has served to correlate many facts

previously known, and to justify the employment of the old term *constitutio lymphatica* revived by A. Paltauf for the general condition. That some underlying constitutional defect must be assumed to exist in order to account for many sudden deaths usually referred to the pressure of an enlarged thymus upon the trachea, bronchi, or great vessels, was the conclusion reached by Paltauf and others from a long experience with this class of cases at the *Institut für gerichtliche Medicin* in Vienna.

Since the time of Friedleben, who in 1858 denied that a normal or hypertrophic thymus gland could produce fatal laryngismus, there has been constant discussion of the manner of death in many cases of sudden death without apparent organic cause other than enlargement or persistence of the thymus, nor are opinions as yet in agreement on this subject. Many writers still claim that death in these cases is produced either by direct pressure of the enlarged thymus upon the bronchi or great vessels, or by reflex cardiac or respiratory paralysis arising from the thymus. Of such writers may be mentioned Recklinghausen, Nordmann, Gluck, Pott, Seydel, Grawitz, and Benecke, and their reported cases indicate that under some circumstances the pressure of an enlarged thymus may reach a dangerous degree. Only a small percentage of the deaths could, however, be explained on such a basis, as the patients usually died very suddenly and the hypertrophy of the thymus was often inconsiderable.

The observations of Paltauf convinced him that many of these fatalities, especially in infants, must be referred to a capillary bronchitis, of which the post-mortem evidences are often very meagre, and the observations of Paltauf, Hoffmann, and Kolisko have led them to believe that all the others are referable to a peculiar constitutional defect, of which an expression is to be found in general hyperplasia of the lymphatic structures. In the experience of these observers, the enlargement of the thymus in these cases is only one feature of a general lymphatic hyperplasia, involving also the spleen, the tonsillar ring, the thoracic and abdominal lymph nodes, and sometimes the bone marrow. Moreover, an examination

of the cases of "*thymus Tod*" reported by earlier writers, even those of Friedleben, discloses the fact that in the majority of instances it was noted that the tonsils, spleen, and lymph nodes were more or less hypertrophic, although no particular significance was attached to this fact at the time.

The same observers noted a similar condition of general hyperplasia of the lymphatic structure of the body in a series of sudden deaths during chloroform narcosis, and the study of these cases, which have recently been collected by R. Kundrat, together with the reports of similar cases from other sources, renders it possible to give a somewhat detailed description of the pathological changes in the enlarged organs, and of the other characteristics found at autopsy in these cases.

Pathological Changes in the Lymphatic Structures.—The thymus frequently measures from six to ten centimetres in length, reaching at times from the middle lobe of the thyroid to the heart's apex. Its consistence may be increased or it may be soft and exude on section a milky white fluid. It has been found adherent to the pericardium, and often encircles more or less completely the great vessels. The blood content of the organ is often found increased, and its surface or section may present the petechiæ characteristic of death by asphyxia. The histology of the enlarged gland indicates usually a simple hyperplasia of the lymphoid cells, enlarging and multiplying the follicles, sometimes causing the deposit of small nodules of lymphoid cells in the centres of lobules, in the trabeculæ, or even in the outlying adipose tissue.

The enlargement of the spleen is of moderate grade, and is referable to a simple hyperplasia of the lymphoid elements, with hyperæmia. The enlarged Malpighian bodies being usually devoid of blood and light colored, are prominently set off from the hyperæmic pulp, giving an appearance not unlike that of miliary tubercles. In some cases the lymphoid cells are so much increased as to infiltrate the splenic pulp, and the microscopical outlines of the follicle are then indistinct.

The pulp cells may contain an increased deposit of blood pigment, of which condition one of the present cases furnishes an extreme example.

The lymph nodes most frequently affected are the pharyngeal, thoracic, and abdominal chains. The faucial and lingual tonsils are nearly always enlarged, the new cells not always being confined to normal limits, but sometimes forming a diffuse infiltration of the mucous membrane about the original follicles. From the lingual tonsil the infiltration may involve the epiglottis and sinus pyriformis.

The cervical, mediastinal, and axillary nodes may be moderately enlarged, especially along the course of the great vessels. Tubercular lymphadenitis has been observed (Bayer).

The abdominal lymph nodes, especially those of the intestine and mesentery, are usually strikingly enlarged. In one of the present cases some of the Peyer's patches measure nine to eleven centimetres in length, and their follicles and the solitary follicles project very prominently above the surface of the mucosa. The swollen mesenteric nodes may remain entirely discrete, or, as in the present case, they may form a solid mass of lymphatic tissue, in which the separate nodes are closely applied one against the other, although the capsules remain intact. The enlargement is due to a simple hyperplasia; the lymph paths appear for the most part undisturbed, but the adjoining connective and adipose tissue may contain a moderate deposit of new lymphoid cells. The retro-peritoneal nodes are often affected. The mesenteric nodes may be enlarged when the intestinal follicles appear normal. The nodes of the entire gastro-intestinal tract are frequently involved in the hyperplasia. The inguinal, popliteal, axillary, cervical, supraclavicular, and infraclavicular nodes may be moderately enlarged. Small collections of lymphoid cells have been found in the thyroid gland, which is frequently enlarged in these cases. Similar collections of lymphoid cells were noted in the capillaries of the liver in one of Kundrat's cases, aged fifteen years. In three of Kundrat's cases, aged fif-

teen, twenty-four, and thirty-one years, red marrow was found in the shaft of the femur. In only one of these cases, however, does it seem certain that this unusual condition represented a true lymphoid hyperplasia, as in Case II, in which there was noticeable atrophy of fat cells and more or less diffuse lymphoid tissue in the marrow, containing neutrophile and eosinophile myelocytes and dense nodules of lymphoid cells. The marked variability of the character of the bone marrow in the femur has been amply demonstrated by the extensive studies of Grohé, and of Litten and Orth.

Relation to Pseudo-leucæmia.—Such a general and extensive hyperplasia of the lymphatic structures of the body at once suggests a possible connection with leucæmia or pseudo-leucæmia. The resemblance to these diseases is especially evident in those cases showing extensive enlargement of the mesenteric nodes or diffuse infiltration of mucous membranes with lymphoid cells, or collections of lymphoid cells in unusual situations, as in the hepatic capillaries and thyroid gland. The destruction of red blood-cells characterizing these diseases has been approached in cases of the lymphatic constitution, as indicated by the deposit of blood pigment in the spleen and lymph nodes, a condition well marked in the spleen in one of the writer's cases. Koeppe reports a similar case in which the deposits of pigment were very extensive, and also notes an increased number of leucocytes in sections of many vessels, without stating the character of the leucocytes, an observation to which it seems hardly possible to attach any significance. In one of the writer's cases eighty-four per cent. of a considerably increased number of leucocytes in a pial vein were small and mononuclear. Ortnier observed in one case a lymphocytosis at a time when it was not known that a lymphocytosis is usually found in the blood during the second week of typhoid fever. In three of Kundrat's cases the extent of lymphatic hyperplasia might have sufficed for an early stage of leucæmia.

But even these many isolated points of resemblance constitute no distinct indication that the *constitutio lym-*

phatica has any immediate connection with pseudo-leucæmia or leucæmia.

Comparing the enlarged intestinal follicles in the writer's first case with the intestinal lesions of some undoubted cases of pseudo-leucæmia, characteristic differences were noted. The small nodules of new lymphoid tissue in the latter disease grow laterally for some distance before producing much elevation of the mucosa, while in the former the enlarged follicles are very shortly circumscribed and very early project above the surface of the surrounding mucosa. The nodules in pseudo-leucæmia frequently ulcerate at their central points owing to deficient blood supply, a tendency entirely lacking in the enlarged but well vascularized follicles in the former condition. In most cases of pseudo-leucæmia of intestinal type there are some distinctly pedunculated polypoid outgrowths, considerably exceeding in size any of the hyperplastic nodules yet reported in cases of the lymphatic constitution.

In the majority of the cases of lymphatic constitution the enlargement of the lymph nodes does not pass beyond the limits of what may be called a physiological hypertrophy, and bears little resemblance to a tumor formation. The spleen is rarely much enlarged. The presence of considerable pigment in the spleen pulp is too ordinarily seen to be interpreted positively as the result of an excessive blood destruction, such as characterizes the severe anæmias. Yet it must be admitted that the very considerable degree of pigment deposit reached by the two cases referred to above indicates that in some instances the blood has suffered severely. These children are, however, not usually anæmic, but in excellent health, and even the sickliest of them do not resemble cases of infantile leucæmia, pseudo-leucæmia (von Jaksch), or chlorosis. As for the hyperplasia of the lymphoid marrow, it may be said that the normal limits of lymphoid marrow are as yet by no means definitely settled. Such hyperplasia may be seen also in the secondary anæmias, and in any case the hyperplasia of the lymphoid marrow may be regarded as merely a part of the general and

more or less physiological hypertrophy of the lymphoid structures of the body.

It is worth noting, in this connection, the apparent possible explanation of some cases of lymphocytosis in children, which is so frequently observed at this age, and has at present little definite significance. It might be expected that a general lymphatic hyperplasia would lead to a lymphocytosis such as was present in the writer's case to a marked degree. That all children showing persistent lymphocytosis are subjects of the lymphatic constitution can not now be asserted. In the writer's experience, children with extreme lymphocytosis may at least survive severe attacks of diphtheria. Nevertheless, it must be regarded as possible that the persistent lymphocytosis of childhood may at times be a tangible expression of general lymphatic hyperplasia and of the lymphatic constitution.

Relation to Rhachitis.—In a considerable proportion of the reported cases of *constitutio lymphatica* more or less pronounced evidences of rhachitis have been found.

Professor Kundrat described as primary vegetative disorders those anomalies of growth whose cause we do not know, and which we must refer to a congenital predisposition. Rhachitis he specially emphasizes as representing not only a disturbance in bone formation, but a profound and general vegetative dyscrasia. This view of the pathology of rhachitis, which is, of course, the one in general acceptance, is here mentioned in order to emphasize the fact that the coincidence of rhachitis, which is not an essential feature of the lymphatic constitution, must be regarded, with the hypoplasia of the heart and arteries, as further evidence of some deep-seated constitutional weakness.

It is interesting in this connection to recall the fact without speculating upon its significance, that a large percentage of rhachitic children have a hypertrophic spleen, which is, however, according to the recent conclusions of Starck, not uniformly proportionate to the grade of rhachitis, but rather to the degree of anæmia.

The coincidence of rhachitis and enlargement of the spleen with hyperplasia of lymph nodes, especially the mesenteric nodes, was long since noted by Dickinson and Glisson.

Significance of Enlargement of the Thyreoid in the Lymphatic Constitution.—In nine of the seventeen cases collected by Kundrat, in three of seven referred to by Paltauf, and in one of the writer's two cases—*i. e.*, in more than fifty per cent. of twenty-six cases—the thyreoid gland was found enlarged. Of the significance of the goître in this connection it is rather difficult to judge. There is, however, abundant evidence to show that some sympathetic relation exists between the thymus and thyreoid.

Beclard found an enlargement of the thyreoid after extirpation of the thymus, and enlargement of the thymus after extirpation of the thyreoid, in animals capable of surviving the loss of these organs. As shown by Kundrat, enlargement of the thymus has been found in Basedow's disease by Möbius and by Spencer, and hypertrophy of lymph nodes, tonsils, and intestinal follicles has been noted in the same disease by several observers (White, Gowers). The liability to sudden cardiac paralysis, which is often the prominent feature in the death of subjects of the lymphatic constitution, finds at least a partial counterpart in the persistent tachycardia of Basedow's disease. Müller believes that a congenital or acquired neuropathic constitution is an essential element in the production of exophthalmic goître.

Exciting Causes and Manner of Death of Subjects of the Lymphatic Constitution.—The majority of cases thus far reported have died as the result of chloroform narcosis. One case reported by Heusler died after ether narcosis and the loss of considerable blood. Death may apparently occur at any stage of the narcosis, during the first few inhalations or even after apparent recovery from the effects of the anæsthetic.

Two patients survived a first administration of chloroform to perish some months later during a second or third operation.

The usual signs of danger may be observed; the patients may respond to treatment for a time, and a few feeble respiratory movements may be elicited for some moments, or for a considerable period, or the cardiac and respiratory paralysis may be instant and complete. In all of these particulars these cases have presented no distinguishing peculiarities.

Seven reports by Nordmann and Paltauf refer to the sudden death of persons who fell into the water, and although immediately recovered were yet dead, or who died suddenly while bathing.

In none of these cases were the ordinary signs of death by drowning to be found, but the usual evidences of the *constitutio lymphatica* were present.

Other persons died suddenly during the excitement of card playing, or fell dead on the street while engaged in ordinary exertions.

The sudden death of the young son of Professor Langerhans, of Berlin, immediately after the injection of a preventive dose of diphtheria antitoxine has called forth considerable discussion as to the probable cause of this sudden fatality, and has been variously explained by Langerhans, Eulenberg, and Pürkhauser. Paltauf suggests that this and other similar cases may find their true explanation in the presence of the *constitutio lymphatica*.

It seems probable, from the considerations relating especially to hypoplasia of the heart and arteries, that some rapidly fatal forms of the infectious diseases, and some sudden fatalities during convalescence from these diseases, may be in part referable to the *constitutio lymphatica*.

It must be emphasized, however, that the data are as yet entirely too limited to indicate definitely the scope of the *constitutio lymphatica*, and until the observations have been very considerably extended it will be well to observe extreme caution before attributing miscellaneous cases of sudden death to the lymphatic constitution.

The manner of death usually indicates a cardiac paralysis, which may or may not be combined with imme-

diate failure of respiration. Of the chain of events by which this result is reached little is known. That the cardiac muscle in these subjects is specially susceptible to the effects of chloroform may naturally be supposed. Very slight importance can at present be attached to the mechanical irritation or pressure of the enlarged thymus. We are therefore compelled to content ourselves with the statement, very plainly supported by clinical experience with these cases, that the subjects of the lymphatic constitution, for unknown reasons, are specially susceptible to reflex cardiac paralysis.

The Diagnosis of the Lymphatic Constitution.—Since it is claimed that the majority of deaths from chloroform are referable to the *constitutio lymphatica*, it becomes a matter of importance to be able to recognize the condition during life. Unfortunately, in the present state of our knowledge this is in many cases impossible, yet a thorough examination of the patient will probably disclose one or more suspicious signs.

It may be possible, first, to elicit physical signs indicative of hypoplasia of the heart and aortic system of arteries, although the conclusions thus reached will be regarded by conservative clinicians as very uncertain.

Fraenkel, Rauchfuss, and Quincke call attention to the dilatation of the left ventricle, which usually results from a narrowing of the aorta. They also recommend the examination of the peripheral arteries, which may be found distinctly narrowed and of increased tension. Ortnet has noted in his cases of narrow aorta an absence of aortic pulsation in the neck, which he regards as a pathognomonic sign of hypoplasia of the aorta, if found in a muscular subject. As already mentioned, hypoplasia of the heart and arteries is frequently associated with an infantile or defective development of other organs and tissues, especially of the sexual organs, the condition of which it may therefore be well to ascertain.

In some of the reported cases the diagnosis was suggested by the absence of pubic hair, by the very late establishment of menstruation, and from a uniformly con-

tracted condition of the pelvis. Yet even granting that attention to the above minutiae may occasionally give rise to a strong suspicion of hypoplasia of the aorta, it is not to be supposed that every case actually presenting this anomaly is a subject of the lymphatic constitution, so that, practically, the diagnosis of this anatomical feature will usually be restricted to the post-mortem table.

Likewise, the prevalence of rhachitis is too general to warrant more than a suspicion that this disease may be associated with the lymphatic constitution, and its presence can only serve as a warning that the two conditions sometimes coexist, rendering the subject a dangerous one for the administration of chloroform.

Of greater diagnostic import is the discovery of a general or local hyperplasia of the superficial lymphatic structures. Enlargement of the faucial, lingual, or pharyngeal tonsils, especially if accompanied by enlarged cervical, axillary, or inguinal lymph nodes, should at once arrest attention. In one of Kundrat's cases there were distinct flat deposits of lymphoid tissue along the base of the tongue and about the epiglottis, and in another the retropharyngeal nodes were moderately enlarged. In one of the writer's cases the enlarged mesenteric nodes formed a tumorlike mass that could readily have been detected by abdominal palpation. In young subjects it may sometimes be possible to elicit dullness from the enlarged thymus.

The demonstration of a well-marked lymphocytosis in one of the writer's cases, a condition which may reasonably be expected to frequently accompany general lymphatic hyperplasia, suggests that the examination of the blood may give a reliable indication in some cases of the *constitutio lymphatica*. The lymphocytosis of early life, which has been rather frequently observed, has as yet acquired little or no significance, and although the suggestion is based upon a single observation, that alone would seem sufficient to urge that the condition of the blood should be noted in every suspected case.

In conclusion, it must be admitted that while the studies of the Vienna observers seem to have placed the

existence of the *constitutio lymphatica* upon a firm basis in pathology, the observations yet remain far too limited to fully demonstrate the truth of an hypothesis which connects a large class of sudden deaths with simple hyperplasia of the lymphatic structures of the body.

It has been deemed advisable, therefore, to place the present cases on record, and it has been the further object of this paper in outlining the chief anatomical features of the lymphatic constitution to urge the claims of the subject to more general attention, especially from those in charge of medico-legal autopsies.

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